RPF Point Paper
DRAFT

Purpose:
The purpose of this briefing is to provide a high-level overview of the technical crosswalk between NIMA's Raster Product Format (RPF) and the Geospatial Data Extensions (GeoSDE) found in Stanag 4545, technical issues and the technical questions that will need to be resolved prior to the migration of RPF.

General Questions:
The possible migration of RPF to a format using GeoSDE will require the following questions be evaluated:

A. Who is using the products?
   - Within the CINCs?
   - Within the Services?
   - Within other Federal Agencies?
   - Within Allied Organizations?
   - Any commercial users?

B. What are the software applications that will be affected as a result of the migration?
   - Government developed applications?
   - Vendor developed applications?
   - Applications in the DOD software repository?

C. Which data fields currently present in the RPF tags are employed by existing software applications and which are ignored?

D. Which of the functions implemented in applications and available to the user under the current RPF format are actually employed by the end users?
   - RPF's File Update/Replace Function
   - History Files
   - Legend Files: Legend files are dealt with in the GeoSDE SOURC extension. Is this compatible with the manner in which the legends are currently presented?
   - Overview Files: How will the format and accessibility of the overview files be affected by the migration?

E. What specific functions are RPF products currently employed for?

Technical Issues:
Additionally, the migration of RPF will require the following technical issues be addressed:

A. RPF's multiple file structure and associated table of contents
B. RPF's file update/replace and history functions
C. RPF's use of external color tables
D. Adequacy of geographic coordinate precision in the GeoSDE
E. RPF has a field to record the 'Old Horizontal Datum Code'. A similar field does not appear in the GeoSDE. Is this needed?
F. RPF has a field to distinguish 'data level', e.g. for DTED level 1 or level 2 data. Is a similar identifier needed in the GeoSDE?

G. The following are RPF reader functions. Should these functions be carried forward?
   - Distance calculations between frame files
   - RPF's continuous view capability (allowing different frame files to appear as a continuous scene)
   - CADRG overview images (these graphically show the location of the frame files) Is there something lacking in the GeoSDE that will inhibit the ability to create overview images?

H. Multiple date fields: will the use of a single date field affect the history function currently available?

The following is a brief discussion of the technical crosswalk between RPF and the GeoSDE described in Stanag 4545.

Table 1. Attribute Fields: RPF Vs GeoSDE (Stanag 4545)

The following table describes the differences in how information is presented in RPF files and the GeoSDE. Differences that are not crucial are simply noted. Those differences that may affect the migration path are discussed in the comment and question sections that follow the table.

RPF Field Name	Comparison to GeoSDE Fields
Currency Date Date of most recent revision to the RPF product in the [frame file] in the form YYYYMMDD.	Note: No Equivalent The role the currency date plays in the history capability of RPF requires further evaluation. How will the currency date present in the NITF header allow the history of the RPF file to be maintained?
Production Date Date that the source data was transformed to RPF format, in the form YYYYMMDD.	Note: No Equivalent The role the production date plays in the history capability of RPF requires further evaluation. How will the production date present in the NITF header allow the history of the RPF file to be maintained?
Significant Date Date that most accurately describes the basic date of the source product in the form YYYYMMDD.	This field matches the GeoSDE. Additionally, the GeoSDE uses a second field to record the activity type, such as, copyright, edition, latest date, earliest date… The GeoSDE may incorporate all of the functionality currently present in RPF. However, the RPF history capability should be evaluated to assess what impact, if any, the use of a single date field would have.
Map/Chart Source 1. Data series designation-a short title for	Appears that three out of the four fields match. The fourth field is an Old

the identification of a group of products usually having the same scale and/or cartographic specification. 2. Map Designation-the designation within the data series, of the hardcopy source. 3. Old Horizontal Datum Code-original horizontal datum of the hardcopy product. 4. Edition Identifier-edition number of the source graphic, which uniquely identifies a product within a series and item number.	Horizontal Datum code. The GeoSDE does not include this field. Is this field necessary? If so, should it still be populated from NIMA TR 8350.2, or is there an alternate reference in DIGEST?
Projection System 1. Projection Code 2. Projection Parameter A 3. Projection Parameter B 4. Projection Parameter C 5. Projection Parameter D Definitions of the projection parameters are given in paragraph 5.3.2.3 of MIL-STD-2411.	Note: The GeoSDE uses both a projection code and projection name (2 fields). Both RPF and the GeoSDE use ASCII: 4 for the code field. The GeoSDE uses ASCII: 25 for the name field. The RPF projection parameters are not handled in the same manner as in GeoSDE. RPF deals with the ……..
Vertical Datum Vertical datum of the RPF [frame file] or areal extent.	Note: The GeoSDE uses both a datum code and datum name (2 fields). Both RPF and the GeoSDE use ASCII: 4 for the code field. The GeoSDE uses ASCII: 25 for the name field.
Horizontal Datum Horizontal datum of this RPF [frame file] or areal extent.	Note: The GeoSDE uses both a datum code and datum name (2 fields). Both RPF and the GeoSDE use ASCII: 4 for the code field. The GeoSDE uses ASCII: 25 for the name field.
Vertical Absolute Accuracy 1. Vertical absolute accuracy for this RPF [frame file] or areal extent. 2. Accuracy units of measure.	RPF expresses accuracy values as 4 byte unsigned integers while the GeoSDE uses ASCII: 5. RPF expresses the units of measure for accuracy as 2 byte unsigned integers number codes while the GeoSDE uses ASCII: 3 (1-3 letter codes). The units are expressed using codes for measures such as feet or meters. The unit code tables in the Stanag cover what is used in RPF. As for the accuracy values themselves, they should not need more than ASCII: 5 to be expressed, but we need to validate this by checking a number of files and determining what the real ranges of the accuracies employed by the users are.
Horizontal Absolute Accuracy	RPF expresses accuracy values as 4 byte

1. Horizontal absolute accuracy of the RPF [frame file] or areal extent. 2. Accuracy units of measure.	unsigned integers while the GeoSDE uses ASCII: 5. RPF expresses the units of measure for accuracy as 2 byte unsigned integers number codes while the GeoSDE uses ASCII: 3 (1-3 letter codes). The units are expressed as codes for measures such as feet or meters. The unit code tables in the Stanag cover what is used in RPF. As for the accuracy values themselves, they should not need more than ASCII: 5 to be expressed, but we need to validate this by checking a number of files and determining what the real ranges of the accuracies employed by the users are.
Vertical Relative Accuracy 1. Vertical relative accuracy of this RPF [frame file] or areal extent. 2. Accuracy units of measure.	RPF expresses accuracy values as 4 byte unsigned integers while the GeoSDE uses ASCII: 5. RPF expresses the units of measure for accuracy as 2 byte unsigned integers number codes while the GeoSDE uses ASCII: 3 (1-3 letter codes). The units are expressed using codes for measures such as feet or meters. The unit code tables in the Stanag cover what is used in RPF. As for the accuracy values themselves, they should not need more than ASCII: 5 to be expressed, but we need to validate this by checking a number of files and determining what the real ranges of the accuracies employed by the users are.
Horizontal Relative Accuracy 1. Horizontal relative accuracy of this RPF [frame file] or areal extent. 2. Accuracy units of measure.	RPF expresses accuracy values as 4 byte unsigned integers while the GeoSDE uses ASCII: 5. RPF expresses the units of measure for accuracy as 2 byte unsigned integers number codes while the GeoSDE uses ASCII: 3 (1-3 letter codes). The units are expressed as codes for measures such as feet or meters. The unit code tables in the Stanag cover what is used in RPF. As for the accuracy values themselves, they should not need more than ASCII: 5 to be expressed, but we need to validate this by checking a number of files and determining what the real ranges of the accuracies employed by the users are.
Ellipsoid	Note: The GeoSDE uses both an ellipsoid

Ellipsoid used in this RPF [frame file] or areal extent.	code and ellipsoid name (2 fields). Both RPF and the GeoSDE use ASCII: 4 for the code field. The GeoSDE uses ASCII: 25 for the name field.
Sounding Datum Sounding Datum used in this RPF [frame file] or areal extent.	Note: The GeoSDE uses both a sounding datum code and sounding datum name (2 fields). Both RPF and the GeoSDE use ASCII: 4 for the code field. The GeoSDE uses ASCII: 25 for the name field.
Navigation System Navigation system used in this RPF [frame file] or areal extent.	Note: RPF uses a 2 byte unsigned integer number code while the GeoSDE uses ASCII: 3, a 1-3-letter code. The code used in the Stanag should work for this field in an RPF file.
Grid Grid code for this RPF [frame file] or areal extent.	Note: The GeoSDE uses both a grid code and grid names (2 fields). Both RPF and the GeoSDE use ASCII: 4 for the code field. The GeoSDE uses ASCII: 25 for the name field.
Easterly Annual Magnetic Change 1. Annual magnetic change in the easterly direction for this RPF [frame file] or areal extent. 2. Units of magnetic change.	Note: The value of the annual magnetic change is expressed in real: 4 in the RPF. The GeoSDE uses ASCII: 8 to express the value of the change. The units of measure for magnetic change are expressed as a 2 byte unsigned integer in RPF and ASCII: 3 in the GeoSDE. The table used to express the units of measure in the GeoSDE is very comprehensive and could be used for the RPF. Additionally, the GeoSDE includes a field for the date of the magnetic information.
Westerly Annual Magnetic Change 1. Annual magnetic change in the Westerly direction for this RPF [frame file] or areal extent. 2. Units of magnetic change.	Note: The value of the annual magnetic change is expressed in real: 4 in the RPF. The GeoSDE uses ASCII: 8 to express the value of the change. The units of measure for magnetic change are expressed as a 2 byte unsigned integer in RPF and ASCII: 3 in the GeoSDE. The table used to express the units of measure in the GeoSDE is very comprehensive and could be used for the

	RPF. Additionally, the GeoSDE includes a field for the date of the magnetic information (ASCII: 8) and two fields that locate a reference point (ASCII: 15).
Grid North-Magnetic North Angle 1. Angle between north/south grid lines and magnetic north in this [frame file] or areal extent. 2. Units of angle.	Note: The same number of fields is used in both the GeoSDE and RPF to express the same information. The angle is expressed as real: 4 in RPF and ASCII: 8 in the GeoSDE. The units of measure are expressed as a 2 byte unsigned integer for RPF and ASCII: 3 for the GeoSDE. The GeoSDE again refers to the table for the units of measure and uses 1-3-letter codes.
Grid Convergence Angle 1. Angle between grid north and true north in this [frame file] or areal extent. 2. Units of angle.	Note: The same number of fields is used in both the GeoSDE and RPF to express the same information. The angle is expressed as real: 4 in RPF and ASCII: 8 in the GeoSDE. The units of measure are expressed as a 2 byte unsigned integer for RPF and ASCII: 3 for the GeoSDE. The GeoSDE again refers to the table for the units of measure and uses 1-3-letter codes.
Highest Known Elevation 1. Highest known elevation for the RPF frame or areal extent. 2. Units of measure. 3. Latitude of elevation. 4. Longitude of elevation.	Note: Elevation values for RPF are expressed as real: 8 while expressed as ASCII: 6 or ASCII: 15. The units of measure are 2 byte-unsigned integers in the RPF file and ASCII: 3 in the GeoSDE. The GeoSDE again refers to the table for the units of measure and uses 1-3-letter codes.
Multiple Legend Name of the legend file that applies to this areal extent.	At this point, the legend files appear to have the same format as a frame file, so this should not pose too much of a problem. How are the multiple legend files going to be indexed using GeoSDE?
Image Source 1. Source of the data from which this RPF data was derived. 2. Ground sample or post distance of the RPF data.	Source information is handled in the source tag in the GeoSDE. The format and required fields of the source GeoSDE has been tabled by DIGEST for the time being. The GeoSDE provide a more comprehensive listing of source

	information.
Data Level The level of the source for this data. This field would distinguish between DTED Level 1 and DTED Level 2, for example.	This may be a product specific field. Not sure how this would be distinguished using the GeoSDE.

Table 2. RPFIMG Section Comparison:

RPF Fields	Comparison to GeoSDE Fields
Location Section	If the products migrate to the use of the GeoSDE will it be necessary for this index section to be present? It allows the RPF reader to skip NITF fields and find specific RPF defined components. Bill Cooke suggested this information be part of the RPFHDR or RPFIMG tag.
Coverage Section	Each of the GeoSDE provides fields to describe the bounding polygon that tag is related to. RPF defines the bounding polygon using real: 8 while the GeoSDE define the polygon using ASCII: 15. This difference should not pose a problem in presenting lat/long values.
Compression Section	NITF Image Data
Color/Greyscale Section	NITF subheader fields could support this section.
Image Section	The mask subsection, image display parameters and spatial data subsection are NITF Image Data. NITF subheader fields could support the image description subheader.
Attribute Section	Details for the attribute section are described in Table 1. This is where most of the information related to the GeoSDE resides.
Related Images Section	No equivalent
Replace/Update Section	No equivalent

Technical Questions:

A. It appears that the information present in the RPF file is complete enough to fill in any of the accuracy GeoSDE. However, the SOURC extension and Sensor

Parameter (SNSPS) extension have several required fields that contain information not currently present in the RPF extensions. How would NIMA propose to deal with the required fields and is this going to present a problem migrating to the established GeoSDE?

B. What are the true value ranges of the accuracies used in an RPF file? The RPF format allows for a 4 byte-unsigned integer. Is this a necessity or will the accuracy values fit within a field size of ASCII: 5?

C. Is a geographic coordinate precision greater than one arc-second necessary?

D. At the end of the attribute section in the CADRG are several sets of coordinates. These coordinates identify the varying attribute values within one frame file. Why are the same coordinate sets repeated?

E. If the update/replace function and the legend files have the same format as the frame files, there should not be too much of a problem migrating to the GeoSDE. The update/replace files would need some pointer attached that would tell the application which frame file to replace. However, if the update is of an underlying map, how will this be handled using Annex E?

Comments:

A. How are we going to deal with the parameter information currently present in the projection system RPF field?

B. The most apparent difference between the GeoSDE and RPF files is the field types used. RPF uses unsigned integers and real numbers while the GeoSDE use only ASCII. This should not present too much of a problem though, the information is the same, and it is just being expressed differently. The GeoSDE use a standard set of tables for all of the codes. These tables appear to very complete and using them with the different file types should not be difficult.

C. Two raster products, CIB and CADRG, were evaluated. The CIB files evaluated are consistent among themselves but are not consistent with the CADRG files. The CADRG products are not consistent among themselves. The number and types of attributes described in the CADRG files varies. There are CADRG files that have no attributes associated with them and there are those that have a complete set.

D. It appears that there is no standard method of entering input to the sub-directory level of an RPF file. The length of A.TOC sub-directory file names was found to range from nine to eleven.

E. There should be some method for identifying what type of data is contained within an RPF volume (CADRG, CIB or DTED).

F. As of February 1998, it was determined that Annex E, as currently written, will not support the multiple layer format of the RPF Table of Contents. Annex E is keyword based while RPF is position-based (such as NITF). Additionally, Annex E does not support the current Update/Replace function or sub-frame structure of RPF. There is a need for more security information in Annex E as well as a flag to indicate whether the data contained in a frame file is original, a new edition or a subframe update patch. The following list defines additional fields and interpretations necessary for the migration of the RPF A.TOC file to Annex E (Reference: Technical Notes, Mr. Bill Kannawin, 24 February, 1998):

- RPF country codes may cause a problem due to the fact that DIGEST does not recognize county codes.
- The endian flag should be associated with the Bounding Rectangles so a combination of big/little endian conventions may be used.
- Each Bounding Rectangle could be interpreted as a separate DIGEST library. Not sure that this will address the multilevel structure down to the frame file level--we still may be one level too high to incorporate RPF.
- Suggested fields to add to DIGEST Annnex E:
  - Compression ratio
  - Scale or resolution
  - Producer
  - Zone
  - N-S & E-W resolution
  - Vertical and Horizontal pixel interval
  - Number of frames N-S and E-W
  - Highest Security
- Possible Unnecessary RPF Fields
  - The pointer to the location section
  - Length (in bytes) of the location section
  - Offset of the component location table
  - Number of component location records
  - Length of these records
  - Aggregate length of the component
- The Bounding Rectangle Section Header describes how the data is encapsulated (offset, number of bounding rectangles and the length of each record). Corresponding information needs to be considered for Annex E.
- Suggested methodology for dealing with Frame Files
  It may be possible to use the tile approach as described in VRF Annex C of DIGEST to support the frame files of RPF. Alternatively, frame file records could be placed behind each DIGEST library metadata file. This approach still does not address the problem of how to access the individual frame files easily. The bounding rectangles of RPF are not the coordinate sets a reader should be searching on as one frame file may be associated with more than one bounding rectangle. Additionally, multiple frame files may be associated with one bounding rectangle.

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- VRF Encapsulation of the TOC Information
- Overall Suggestions